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# Injuries as a result of two-wheeler accidents and its relationship with the COVID-19 pandemic

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## ABSTRACT

**Aims:** The numbers of two-wheeled vehicle (TWV) accidents are rising continually. Social isolation caused by the Covid-19 pandemic affected the frequency of such accidents. This study was conducted in order to examine the general characteristics of victims presenting to the emergency department due to TWV accidents and to investigate the effect of the pandemic on such incidents.

**Methods:** This retrospective study involved patients involved in TWV accidents. Presentations made prior to 11 March, 2020, were classified as the pre-pandemic period and those made subsequently as the pandemic period. The type of TWV, the accident mechanism, victims' demographic characteristics, possession of a driver's license, crash helmet use, injuries observed in victims, trauma severity scores (Glasgow Coma Scale[GCS]; injury severity score[ISS]; and revised trauma score[RTS]), laboratory test and imaging results, victims' clinical outcomes (discharge, admission, or exitus), and the daily numbers of presentations to the emergency department due to TWV accidents before and after the pandemic were recorded.

**Results:** A-349 patients were included in the study, 77.3% involved in motorcycle accidents and 22.7% in bicycle accidents. The mean age of the entire victim group was 24.48±13.52 years, and 93.1% were male. Riders comprised 93.7% of the victims and passengers 6.3%. Driver's licenses were possessed by 16.6% of the victims, and 9.5% wore crash helmets. Motorcycle accidents were most frequently due to "falls associated with loss of balance", and bicycle accidents as a results of "collision with another vehicle or object". The three most commonly injured regions were the extremities, head, and thorax. RTS levels were 10.13±3.51 before the pandemic and 11.98±0.20 during it (p=0.046). ISS levels were 16.07±21.27 before the pandemic and 13.29±17.28 during it (p=0.259). The pre-pandemic mortality rate was 3.9%, while no fatal accidents occurred during the pandemic (p=0.068). Daily numbers of presentations to the emergency department due to TWV accidents were 0.09 before the pandemic and 0.17 during it.

**Conclusion:** TWV accidents are frequently observed among young/middle-aged men. The great majority do not hold driver's licenses, and crash helmet use is low. The extremities are the most frequently injured regions in such accidents. The number of accident victims presenting to the emergency department due to TWV accidents during the pandemic was almost twice as high as in the pre-pandemic period. The trauma energy of accidents occurring during the pandemic was lower than that in the pre-pandemic period, victims suffered less harm from trauma, and mortality decreased.

**Keywords:** Emergency department, bicycle, Covid-19 pandemic, motorcycle, traffic accident

## INTRODUCTION

Reasons for the use of two-wheeled vehicles (TWVs) differ among communities, depending on their level of socioeconomic development. While TWVs are frequently used for day to day purposes such as carrying goods and transport in countries with low income levels (such as India, Indonesia, and Brazil), in countries with high socioeconomic levels (such as the USA, the Netherlands, and Germany) they are employed for sport, fun, or travel.[1-3] Vehicles such as bicycles and motorcycles are frequently used to solve transportation problems in countries such as China, with high traffic density where vehicular speed sometimes falls to as low as 5-6 km/hour.[3] In Turkey, in addition to all these reasons, TWVs are also frequently employed in settlement areas with flatter topographic characteristics, such as Konya, Adana, İskenderun, and İzmit.[4]

Restrictions resulting from the Covid-19 pandemic led to changes in people's daily habits, and due to social isolation and quarantine, efforts began being made to meet almost all daily needs, particularly food and drink habits, through e-commerce or local companies.[5,6] Suppliers seeking to meet day-to-day needs either expanded their existing courier networks or else established new ones (particularly motorbike couriers) to reach customers in isolation.[7,8] Although a rise in the number of TWV accidents during

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the pandemic was predicted in the light of numerous factors, such as the physical condition of the roads, inadequacies in the transportation system, high vehicle numbers, traffic regulation violations, failure to use personal protective equipment (such as crash helmets, gloves, and knee and elbow pads), alcohol and substance use, rider inexperience, economic causes, and lengthy working hours, some studies have suggested the opposite.[9,10]

This study has two purposes. The first is to examine the general characteristics of TWV accidents whose victims present to the emergency department. The second aim is to investigate the effect of the pandemic on TWV accidents.

## METHODS

### Study Design

This retrospective study involved patients presenting to the Kırıkkale University Medical Faculty Hospital emergency department due to TWV accidents between 01 January, 2013 and 31 December, 2021. The study was carried out with the permission of Kırıkkale University Non-Interventional Researches Ethics Committee (Date:09.12.2021, Decision No: 2021.12.04). The Declaration of Helsinki was strictly adhered to during the study. Patient data were retrieved from the hospital's data-processing automation system and archive records. Non-TWV accidents and patients whose record information was unavailable were excluded. The nature of the TWV accident, the mechanism involved, the victims' demographic data, whether the driver had a driver's license, crash helmet use, physical examination findings at the time of presentation, laboratory and imaging test results, and clinical outcome (discharge, admission, or mortality) were recorded. Electrical/battery powered TWVs were classified into motorcycle or bicycle categories depending on their characteristics. Presentations made before 11 March, 2020, when Covid-19 was officially declared to be a pandemic by the WHO, were classified as the "pre-pandemic period", and those made after that date as the "pandemic period".

### Statistical Analysis

The study data were analyzed on SPSS version 21.0 software. Descriptive statistics were expressed as number (n), frequency (%), and mean ± standard deviation (±SD). Normality of data distribution was evaluated using the Kolmogorov-Smirnov test. Independent sample t-test was applied in the comparison of normally distributed variables and the Mann-Whitney U-test in case of non-normal distribution. Categorical variables were compared using Pearson's chi-square test. p values <0.05 were regarded as statistically significant.

## RESULTS

Four hundred seven individuals presented to the emergency department during the study period, although 58 with deficient data were excluded, and the research was completed with 349 accident victims. The victims' general characteristics are shown in **Table 1.**

TWV accidents in general were found to occur most frequently in 2021, in June, and between the hours of 16.00 and 20.00. Motorcycle accidents were most frequently due to "falls associated with loss of balance", and bicycle accidents as a results of "collision with another vehicle or object" (**Table 2**).

**Table 1. The accident victims' general characteristics**

| | |
|---|---|
| Age (years) (n=349) | mean±SD |
| All patients | 24.48±13.52 |
| Motorcycle | 25.97±12.24 |
| ▪ Motorcycle, (n=266) | 25.87±12.11 |
| ▪ Electric motorcycle, (n=4) | 32.75±20.13 |
| Bicycle | 19.39±16.28 |
| ▪ Bicycle, (n=67) n | 15.61±12.83 |
| ▪ Electric bicycle, (n=12) | 33.18±20.14 |
| Sex | n (%) |
| Male | 325 (93.1) |
| Female, | 24 (6.9) |
| Victim | n (%) |
| Driver/Rider | 327 (93.7) |
| Passenger | 22 (6.3) |
| Clinical outcome | n (%) |
| Discharged from the emergency department | 258 (73.9) |
| Admitted to the ward | 86 (24.6) |
| Admitted to intensive care | 17 (19.8) |
| Exitus | 10 (4.9) |
| ▪ Exitus in the emergency department | 5 (50) |
| ▪ Exitus in intensive care | 5 (50) |
| Accident mechanism | n (%) |
| Motorcycle (n=270) | |
| ▪ Falls associated with loss of balance | 130 (48.3) |
| ▪ Rollover and drift due to a secondary agent | 26 (9.7) |
| ▪ Single vehicle accident | 14 (5.2) |
| ▪ Multi-vehicle accident | 99 (36.8) |
| Bicycle (n=79) | |
| ▪ Falls associated with loss of balance | 15 (19) |
| ▪ Rollover and drift due to a secondary factor | 3 (3.8) |
| ▪ Single-vehicle accident | 2 (2.5) |
| ▪ Multi-vehicle accident | 59 (74.7) |

**Table 2. Distributions of two-wheeled vehicle accidents by time and the accident mechanism**

| | Motorcycle | Bicycle | Total |
|---|---|---|---|
| Year of presentation | n (%) | n (%) | n (%) |
| ▪ 2013 | 15 (5.6) | 2 (2.5) | 17 (4.9) |
| ▪ 2014 | 30 (11.1) | 7 (8.9) | 37 (10.6) |
| ▪ 2015 | 30 (11.1) | 3 (3.8) | 33 (9.5) |
| ▪ 2016 | 27 (10.0) | 6 (7.6) | 33 (9.5) |
| ▪ 2017 | 32 (11.9) | 16 (20.3) | 48 (13.8) |
| ▪ 2018 | 24 (8.9) | 6 (7.6) | 30 (8.6) |
| ▪ 2019 | 39 (14.4) | 13 (16.5) | 52 (14.9) |
| ▪ 2020 | 34 (12.6) | 11 (13.9) | 45 (12.9) |
| ▪ 2021 | 39 (14.4) | 15 (19.0) | 54 (15.5) |
| Month of presentation | n (%) | n (%) | n (%) |
| ▪ January | 9 (3.3) | 1 (1.3) | 10 (2.9) |
| ▪ February | 14 (5.2) | 1 (1.3) | 15 (4.3) |
| ▪ March | 20 (7.4) | 3 (3.8) | 23 (6.6) |
| ▪ April | 24 (8.9) | 2 (2.5) | 26 (7.4) |
| ▪ May | 28 (10.4) | 6 (7.6) | 34 (9.7) |
| ▪ June | 36 (13.3) | 17 (21.5) | 53 (15.2) |

| | | | |
|---|---|---|---|
| ▪ July | 30 (11.1) | 11 (13.9) | 41 (11.7) |
| ▪ August | 39 (14.4) | 12 (15.2) | 51 (14.6) |
| ▪ September | 30 (11.1) | 10 (12.7) | 40 (11.5) |
| ▪ October | 20 (7.4) | 7 (8.9) | 27 (7.7) |
| ▪ November | 13 (4.8) | 3 (3.8) | 16 (4.6) |
| ▪ December | 7 (2.6) | 6 (7.6) | 13 (3.7) |
| Time of presentation | n (%) | n (%) | n (%) |
| ▪ 08:00-12:00 | 31 (11.5) | 8 (10.1) | 39 (11.2) |
| ▪ 12:00-16:00 | 85 (31.5) | 22 (27.8) | 107 (30.7) |
| ▪ 16:00-20:00 | 69 (25.6) | 39 (49.4) | 108 (30.9) |
| ▪ 20:00-00:00 | 52 (19.3) | 7 (8.9) | 59 (16.9) |
| ▪ 00:00-04:00 | 25 (9.3) | 3 (3.8) | 28 (8) |
| ▪ 04:00-08:00 | 8 (3) | 0 (0) | 8 (2.3) |

No difference was determined in vital findings between individuals involved in motorcycle and bicycle accidents. Blood ethanol levels were investigated in 232 accident victims and exceeded legal limits (>0.5 promille or 50 mg/dL) in 6.5%. The extremities were most frequently injured region as a result of accidents (64.8%). No difference was found between motorcycle and bicycle accident victims in terms of regions of injury. However, victims presenting to the emergency department due to motorcycle accidents had higher ISS scores than bicycle accident victims (p=0.005). No difference was observed between the two groups in terms of other trauma scores (Table 3).

**Table 3. A comparison of motorcycle and bicycle accident victims**

| | Motorcycle | Bicycle | |
|---|---|---|---|
| Vital findings | mean±SD | mean±SD | p*,† |
| ▪ Body temperature (°C) | 36.14±0.29 | 36.24±0.30 | 0.059 |
| ▪ Heart rate (beats/min) | 78.95±11.76 | 81.73±12.95 | 0.074 |
| ▪ RR(/min) | 17.51±5.52 | 17.18±1.95 | 0.605 |
| ▪ SBP (mmHg) | 124.47±10.87 | 121.83±13.11 | 0.074 |
| ▪ DBP (mmHg) | 75.19±9.88 | 76.86±8.94 | 0.183 |
| ▪ Oxygen saturation (%) | 96.27±2.44 | 96.60±1.92 | 0.264 |
| Trauma score | mean±SD | mean±SD | |
| ▪ GCS | 14.49±2.25 | 14.84±1.35 | 0.200 |
| ▪ ISS | 16.99±21.44 | 9.67±14.53 | 0.005* |
| ▪ RTS | 11.60±2.00 | 11.77±1.50 | 0.489 |
| ▪ PTS | 9.97±3.68 | 10.94±2.09 | 0.090 |
| Ethanol (0-1.79) (mg/dL) | 0.060±0.23 | 0.008±0.02 | 0.174 |
| Injured region | n (%) | n (%) | |
| ▪ Head | 96 (35.5) | 29 (39.7) | 0.868 |
| ▪ Neck | 13 (4.8) | 2 (2.7) | 0.376 |
| ▪ Thorax | 52 (19.2) | 17 (23.2) | 0.668 |
| ▪ Abdomen | 28 (10.3) | 6 (8.2) | 0.459 |
| ▪ Pelvis | 29 (10.7) | 10 (13.6) | 0.642 |
| ▪ Extremity | 180 (66.6) | 45 (61.6) | 0.214 |

RR, Respiratory rate; SBP, Systolic blood pressure; DBP, Diastolic blood pressure; GCS, Glasgow Coma Scale; ISS, Injury Severity Score; RTS, Revised Trauma Score, PTS, Pediatric Trauma Score.
*Independent sample t test; †Pearsons's chi-square test.

Two hundred fifty-six victims presented to the emergency department due to TWV accidents before the pandemic and 93 during it. Pre-pandemic presentations were most common in 2019, in August, and during the hours of 12:00 and 16:00 (30.9%) and 16:00 and 20:00 (30.9%). Presentations during the pandemic were most common in 2021, in July, and between the hours of 16:00 and 20:00 (31.2%) and 12:00 and 16:00 (30.1%). The mean number of accident victim presentations per day was 0.09 during the pre-pandemic period and 0.17 during the pandemic. Motorcycle accidents represented 74.8% of incidents in the pre-pandemic period and 73.1% during the pandemic (p=0.253) (Table 4).

**Table 4. Pre-pandemic and pandemic distributions of two-wheeled vehicle accidents**

| | Pre-pandemic (n=256) | Pandemic (n=93) |
|---|---|---|
| Type of TWV | n (%) | **n (%)** |
| ▪ Motorcycle | 202 (74.8) | 68 (73.1) |
| ▪ Bicycle | 54 (25.2) | 25 (26.9) |
| Year of presentation | n (%) | **n (%)** |
| ▪ 2013 | 17 (6.6) | - |
| ▪ 2014 | 37 (14.5) | - |
| ▪ 2015 | 33 (12.9) | - |
| ▪ 2016 | 33 (12.9) | - |
| ▪ 2017 | 48 (18.8) | - |
| ▪ 2018 | 30 (11.7) | - |
| ▪ 2019 | 52 (20.3) | - |
| ▪ 2020 | 6 (2.3) | - |
| ▪ 2020 | - | 39 (41.9) |
| ▪ 2021 | - | 54 (58.1) |
| Month of presentation | n (%) | **n (%)** |
| ▪ January | 8 (3.1) | 2 (2.2) |
| ▪ February | 14 (5.5) | 1 (1.1) |
| ▪ March | 19 (7.4) | 4 (4.3) |
| ▪ April | 20 (7.8) | 6 (6.5) |
| ▪ May | 26 (10.2) | 8 (8.6) |
| ▪ June | 37 (14.5) | 16 (17.2) |
| ▪ July | 18 (7.0) | 23 (24.7) |
| ▪ August | 39 (15.2) | 12 (12.9) |
| ▪ September | 31 (12.1) | 9 (9.7) |
| ▪ October | 21 (8.2) | 6 (6.5) |
| ▪ November | 14 (5.5) | 2 (2.2) |
| ▪ December | 9 (3.5) | 4 (4.3) |
| Time of presentation | n (%) | **n (%)** |
| ▪ 08:00-12:00 | 27 (10.5) | 12 (12.9) |
| ▪ 12:00-16:00 | 79 (30.9) | 28 (30.1) |
| ▪ 16:00-20:00 | 79 (30.9) | 29 (31.2) |
| ▪ 20:00-00:00 | 43 (16.8) | 16 (17.2) |
| ▪ 00:00-04:00 | 21 (8.2) | 7 (7.5) |
| ▪ 04:00-08:00 | 7 (2.7) | 1 (1.1) |

TWV accidents in the pre-pandemic period were most frequently the result of "collision with another vehicle or object" (46.9%), while during the pandemic they most commonly resulted from "falls associated with loss of balance" (45.2%). Rates of driver's license possession were 16.1% in the pre-pandemic period and 18.3% during the pandemic (p=0.615). Crash helmet use rates were 9.8% (n=25) before the pandemic and 8.6% (n=8) during it (p=0.287). RTS

scores were 11.98±0.20 during the pandemic and 10.13±3.51 in the pre-pandemic period (p=0.046). No difference was determined between the two groups in terms of other trauma scores. The mortality rate was 3.9% in the pre-pandemic period, but no fatal accidents occurred during the pandemic (p=0.068) (**Table 5**).

**Table 5. A comparison of pre-pandemic and pandemic period accident victims**

| | | | |
|---|---|---|---|
| ▪Multi-vehicle accident | 120 (46.9) | 38 (40.9) | |
| Driver's license | n (%) | n (%) | |
| ▪ available | 41 (16.1) | 17 (18.3) | 0.615 |
| ▪ not available | 211 (83.9) | 76 (81.7) | |
| Crash helmet use | n (%) | n (%) | |
| ▪ Yes | 25 (9.8) | 8 (8.6) | 0.287 |
| ▪ No | 167 (65.2) | 84 (90.3) | |
| Mortality | 10 (3.9) | 0 (0.0) | 0.068 |
| **Trauma score** | **mean±SD** | **mean±SD** | |
| ▪ GCS | 14.45±2.37 | 14.91±0.83 | 0.064 |
| ▪ ISS | 16.07±21.27 | 13.29±17.28 | 0.259 |
| ▪ RTS | 10.13±3.51 | 11.98±0.20 | 0.046* |
| ▪ PTS | 11.52±2.20 | 11.18±1.18 | 0.095 |

GCS, Glasgow Coma Scale; ISS, Injury Severity Score; RTS, Revised Trauma Score, PTS, Pediatric Trauma Score. *Independent sample t test; †Pearsons's chi-square test.

## DISCUSSION

Pedestrians and individuals on bicycles and motorcycles across the world are frequently involved in traffic accidents.[11] Examination of TWV accidents shows that they generally involve young/middle-aged men. A study from Nigeria showed that a large proportion of motorcycle victims were men aged 20-30, while research has reported a mean age of 28.8 in Germany with 90.7% of victims being men, and a mean age of 34.4% in Iran with a male-female ratio of 28/1.[12-14] Although male predominance persisted in bicycle accidents, the mean age was slightly lower. A previous study from the USA reported that males under 21 represented 60% of individuals involved in bicycle accidents.[15] Mean ages in the present study were 25.97±12.24 years for motorcycle accidents and 19.39±16.28 for bicycle accidents, with male gender predominating in both. These findings regarding sex and age are consistent with previous studies in the literature.

Road conditions, daylight, and weather conditions are factors that directly affect driving quality and that are thus closely associated with the occurrence of accidents.[16] Erenler et al. reported that TWV frequently occurred in summer, while Ersan et al. found that the majority of motorcycle accidents took place between the hours of 16:01 and 00:00, while Aşırdizer et al. reported that 75% of bicycle accidents and 65.4% of motorcycle accidents occurred between the hours of 12:01 and 20:00.[17-19] TWV accidents also frequently occurred in summer in the present study. The increased numbers of bicycle accidents in that season may be due to children being given bicycles as presents to celebrate the end of term in the summer and to weather conditions being better suited to the use of TWVs. In addition to other factors, the increase in motorcycle accident numbers may also be attributable to failure to adhere to traffic regulations, speeding, or alcohol consumption. The great majority of victims in the present study presented to the emergency department between 12:00 and 20:00. The fact that this time period coincides with lunch and dinner may have led motorbike couriers to be busier and to drive faster to fulfill their orders and to experience more accidents because of increased vehicular or pedestrian traffic.

Loss of balance is an important mechanism in TWV accidents. Loss of control can lead to the vehicle falling over or to a collision with other objects or vehicles.[20] Koçak et al. reported that the great majority of TWV accidents were caused by "loss of vehicular control", while Ramos-Villalon et al. concluded that they frequently resulted from "collision with a moving object".[21,22] Our findings are consistent with those of previous studies, with motorcycle accidents most commonly resulting from "falls associated with loss of balance" and bicycle accidents most frequently being caused by "collision with another vehicle or object". This may be associated with the physical features of the road impairing balance or control, artificial or geographical obstacles, the use of vehicles incompatible with traffic regulations, and alcohol and substance use.

Minor injuries (such as soft tissue injury or fractures) or life-threatening insults to organs may be observed following TWV accidents.[23] Both motorcycle and bicycle accidents in the present study most commonly resulted in extremity injuries, followed by injuries to the head and thorax. This highlights the importance using crash helmets and other protective equipment among users of TWVs in order to reduce the effects of trauma.

Alcohol and substance use also occupies an important place in traffic accidents.[24] The E-Survey of Road Users Attitudes (ESRA) study involving 48 countries reports of alcohol being detected in the blood of motorcycle riders of 18% in Africa, 15% in America, and 19% in Asia-Oceania, with rates among bicycle users of 15% in America and 19% in Asia-Oceania.[25] Maurer et al. reported that alcohol levels exceeding the legal thresholds were determined in 13.8% of motorcycle riders and 14.1% of bicycle riders at police spot checks on drivers suspected of having used alcohol.[26] The rate of vehicle use under the influence of alcohol among all the accident victims in the present study was 6.5%, but was particularly marked among the motorcycle riders. Our rate of alcohol use among TWV accident victims was lower than that in previous studies. We think that this may be due to the single-center nature of this study, religious and cultural disapproval of alcohol use in Turkey, and to increased traffic checks during the pandemic.

The evaluation of injuries occurring as a result of trauma using trauma scoring systems based on anatomical, physiological, and neurological variables can indicate the intensity of the trauma energy experienced by the victim.[27] Hsieh et al. reported higher ISS scores among elderly individuals involved in motorcycle accidents compared to younger adults (elderly 9.6±6.1; younger adults 8.1±7.3 years) and that mortality and morbidity rose in line with the ISS score.28 Yadollahi et al. reported a mean ISS score of 6.67±9.55, and mean GCS value of 14.45±2.08, and a mean RTS value of 7.70±0.59 in individuals involved in motorcycle accidents.29 In another study, Yılmaz et al. reported a mean GCS value of 12.8±3.9 and value a mean RTS of 7.1±1.7 among individuals involved in bicycle accidents.30 Choi et al. observed a significantly higher ISS level among individuals involved in motorcycle accidents (10.6±12.1) compared to bicycle accidents (7.9±9.9).31 The ISS level of the motorcycle accident victims in the present study (16.99±21.44) was also

significantly higher than that of the bicycle accident victims (9.67±14.53). We attribute this to motorcycles reaching higher speeds than bicycles due to their greater horsepower and/or battery capacity and to greater trauma energy being released at the time of impact.

The emergence of new or expansion of existing courier networks during the pandemic led to a rise in the numbers of such vehicles in traffic. However, the restrictions imposed during the pandemic also represented an obstacle to the use of other vehicles, the numbers of which decreased. Inconsistent data therefore exist concerning TWV accidents during the pandemic. One study of TWV accidents during the pandemic reported a 38.7% decrease in motorcycle-related accidents and a 28.4% decreased in bicycle-associated accidents during the pandemic. DiFazio et al. reported a 75% decrease in all motor vehicle accidents.32,33 However, a study from Turkey reported that the proportion of motorcycle accidents rose from 2.9% to 6.8% during the pandemic, while bicycle accidents decreased from 0.5% to 0.2%.34 Kaya et al. reported an increase in motorcycle accidents during the pandemic and that this was associated with long and intensive working hours and rider inexperience (<30 years).35 In the present study, the daily numbers of patients presenting to the emergency department due to TWV accidents almost doubled during the pandemic compared to the pre-pandemic period. In addition, the ISS scores of these accident victims decreased compared to the pre-pandemic period, while RTS values increased significantly. The mortality rate was 2.9% before the pandemic, but no fatalities were observed in TWV accidents during the pandemic. This suggests that accident victims were exposed to less trauma energy during the pandemic or where less affected by trauma. In addition, increased traffic spot-checks during the pandemic and drivers proceeding more slowly may have resulted in lower-energy traumas in accidents. This idea is also supported by the fact that motorcycle accidents decreased during the pandemic and that no fatalities occurred.

## CONCLUSION

Based on the findings of this study, TWV accidents frequently involve young or middle-aged men, and more commonly occur in the summer and between the hours of 12:00 and 20:00. The great majority of victims, particularly among motorcycle riders, do not wear crash helmets, and the rate of driver's license possession is very low. The extremities, head, and thorax are the most frequently injured anatomical regions. Victims were exposed to less trauma energy in accidents occurring during the pandemic, and mortality rates were lower than in the pre-pandemic period.

### Study limitations

There are a number of limitations to this study. The first and most important involves its retrospective nature. This meant that some data that might be linked to TWV accidents, particularly patient-related data, were unavailable. A second limitation is that the results were obtained from a single center. Some of our results may therefore differ from those obtained in previous studies.

## ETHICAL DECLARATIONS

**Ethics Committee Approval:** The study was carried out with the permission of Kırıkkale University Non-Interventional Research Ethics Committee (Date:09.12.2021, Decision No: 2021.12.04).

**Informed Consent:** Because the study was designed retrospectively, no written informed consent form was obtained from patients.

**Referee Evaluation Process:** Externally peer-reviewed.

**Conflict of Interest Statement:** The authors have no conflicts of interest to declare.

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**Author Contributions:** All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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